

SURVEY OF SPRUCE-FIR MORTALITY IN MAINE - 1978

by

Imants Millers and Henry Trial, Jr.

INTRODUCTION

The eastern spruce budworm, Choristoneura fumiferana (Clem.), annually causes severe defoliation in the spruce-fir type in Maine. Tree mortality begins after about 2 years of severe defoliation, and intensifies with additional damage. Maine Bureau of Forestry staff rates the tree conditions and recommends chemical control where significant mortality becomes imminent without removal of the budworm. However, unusually high budworm populations, owner choice of not spraying, or sensitive areas where spraying is not permitted, result in heavy defoliation and tree mortality appears.

The entomology staff of Maine Bureau of Forestry have identified several areas, each a thousand acres or more, where tree mortality is heavy. These areas provide first opportunities to document spruce budworm defoliation consequences for the present outbreak. The information will strengthen the Environmental Impact Statement for 1979.

The objective of this survey is to estimate the volume and proportion of commercial volume of spruce and balsam fir dead and dying in the severe spruce budworm damage areas.

METHODS

Area Selection

Spruce-fir mortality areas will include commercial size trees where tree mortality has occurred in excess of 25 percent of estimated volume. These areas should be 1,000 acres or more in a continuous block. The mortality areas will be identified by the landowners and the entomology staff of Maine Bureau of Forestry.

Aerial Survey

The mortality areas will be sketch-mapped from air to identify the following strata:

Mortality Class

Severe - more than 50% dead

Heavy - 26% - 50% dead

Moderate - 10% - 25% dead

Stocking Level

Full - Complete crown closure with commercial size spruce-fir type.

Partial - Partial crown closure by commercial size spruce-fir type; may include mix-wood and commercial-noncommercial mixed stands; spruce-fir volume estimated at more than 5 cords per acre.

Non-stocked - Non-type, small trees, or less than 5 cds/a of spruce-fir.

The survey is proposed as a cooperative venture between Entomology Division of Maine Bureau of Forestry and Forest Insect and Disease Management, Portsmouth Field Office, U.S. Forest Service. The former will identify and map damage areas. The latter will ground-check the areas and estimate volume of timber that is dead, dying or alive. Any data available from the landowners that provides similar information will be used in the final report.

Ground Survey

The survey is designed primarily to estimate total commercial volume of the stratum and the commercial volume of dead and dying balsam fir and spruce. A 25% error of the mean estimate will be accepted.

Clusters:

Because of variability of tree mortality within a stand, a cluster method of sampling will be used. Each sample will be a cluster of 5 sample points taken from a representative stand within a stratum. The data for all 5 points will be combined to give 1 estimate or sample.

The number of clusters per stratum will be determined using the range-mean ratio method. First, 3 clusters will be sampled. Then, the range-mean ratio will be determined as follows:

$$\frac{(\text{Highest} - \text{Lowest})}{\text{Average or } \bar{x}} = \text{Range-Mean Ratio}$$

The Range-Mean Ratio will be used for both - total volume, and volume dead and dying. The Range-Mean Ratio may be re-evaluated after each additional sample cluster is taken.

<u>Range-Mean Ratio</u>	<u>No. Sample Clusters Needed</u>
0-0.55	3 or less
0.56-0.90	4
0.91-1.15	5
1.16-1.45	6
1.46-1.75	7
1.76-1.95	8

The location of the clusters will be identified from air. Each cluster must be located in a stand and mortality condition representative of the stratum:

Severe-Fully stocked	SF
Partially stocked	SP
Heavy-Fully stocked	HF
Partially stocked	HP
Moderate-Fully stocked	MF
Partially stocked	MP

These areas should be accessible for sampling.

Sample Points:

Each sample point will be established with a 10 factor basal area prism representing 1/10th acre plot. The 5 sample points will be established in a systematic fashion to have a center point and a point 2 chains away in each cardinal direction. Care must be taken that plot centers are selected at random and that border line trees are measured before acceptance.

Data Collection:

All the data for the 5 sample points will be recorded on the CUMULATIVE VOLUME TALLY - ROUGH CORDS card - balsam fir and spruce separately. First, collect the data for balsam fir, then for spruce - red and white spruce only.

Tally all the trees above 5 in. dbh in the plot by tree condition class:

Dead (d) - No green foliage present; inner bark has browning; small twigs on branches still present (tree less than 3 years dead).

Dying (dy) - Practically no foliage present and appears dead, except that inner bark is still white.

Live (L) - Green foliage present.

Volume estimates for each condition class will be made by measuring d.b.h. and estimating the number of 8 ft bolts in one tree for each condition class in the plot. That tree must be chosen at random. The following method is suggested. Chose 1st tree of the condition class going in clockwise direction from Compass N. If a dead or dying balsam fir is not found on the plot, chose the 1st tree in the line of traverse and record volume. In recording volumes follow directions on the tally card.

LABOR

The aerial survey will be done by the personnel from Maine Bureau of Forestry and U.S. Forest Service. The ground survey will be through the efforts of commercial forest landowners and the U.S. Forest Service. Since we are not sure of the number of areas, and the size of the areas, needing the survey, the number of crews cannot be determined. In general, one crew of 2 persons will be handling their own area. About a crew-week is planned for each area.

ESTIMATED BUDGET

	Project	U.S. FOREST SERVICE Contributed
Salaries	\$1,200	\$5,000
Per Diem	3,600	-
Transportation	1,000	-
Aircraft	1,000	-
Misc. Tools	<u>200</u>	<u>-</u>
Sub-total	\$7,000	\$5,000
TOTAL PROJECT COST		\$12,000

In addition, costs will be contributed by cooperators.

EQUIPMENT

Standard foresters field survey inventory equipment will be needed. Among the major items are:

Compass

Prism, 10x

DBH tape

50 ft tape

DATA ANALYSIS AND REPORT

Estimates of volume of timber dead and dying, and errors of estimation will be presented for each mortality area. Maps and area of each stratum of mortality will be presented. Spraying history of each area will be determined. The report will be presented by the Portsmouth F.O. in cooperation with Maine Bureau of Forestry. The report, or data, should be available for the 1979 Environmental Statement.

FIR

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(Rev. 1/8/60)

CUMULATIVE VOLUME TALLY - ROUGH CORDS

Based on point-sampling with a critical angle of 104.18 minutes (basal area factor of 10) and composite volume tables developed at the Lake States Forest Experiment Station, 1935.
(Table 6, USDA Tech. Bull. No. 1104)

FOREST _____ CRUISER _____ DATE _____

W.C. _____ COMP. _____ T. _____ R. _____ SEC. 40 _____

TYPE & CONDITION _____ ACRES _____ CULL _____

POINTS TALLIED	TREE TALLY AT POINT	DBH	NO OF 8" BOLTS PER TREE - Variable top to 4" d.i.b.								TOTAL CORDS/ACRE			
			1	2	3	4	TALLY LEGEND							
1		6	87	147	157	204	168	240	479	1 Live				
10		6	73	512	713	856	612	313	719	513	0 Dying			
		6	147	157	1284	1113	127	1108	437	X Dead				
		6	433	1855	1998	2140	1835	2038	2156	2195	- Live			
		6	520	2283	2425	2568	2242	2446	2635	2874				
4		6	606	2711	2854	2996	2650	2854	3114	3353	5	6	7	
		8	89	297	430	195	390	249	499	304	608	112		
		8	178	573	715	860	585	780	748	997	911	225	555	
		8	257	1003	1246	1290	974	1169	1247	1496	519	578	597	
		8	355	1433	1575	1720	1364	1559	1743	1999	2127	2430	2460	
		8	444	1863	2006	2150	1754	1949	2244	2493	2734	3038	1662	
		8	533	2293	2435	2579	2144	2339	2743	2998	3342	3646	1995	
		8	622	2723	2866	3009	2534	2728	3241	3491	3949	4253	3227	
		8	711	3153	3295	3439	2923	3118	3740	3989	4557	4861	2560	
		10	90	150	321	451	204	407	244	488	293	587	345	
		10	130	502	752	992	611	814	732	975	880	1174	690	
		10	270	1253	1363	1354	1018	1221	1220	1464	1467	1761	1034	
		10	359	1504	1654	1305	1425	1629	1707	1951	2054	2348	1379	
		10	449	1955	2105	2256	1832	2036	2395	2439	2641	2934	1724	
		10	539	2406	2557	2707	2239	2443	2683	2927	3228	3521	2069	
		10	629	2957	3008	3158	2646	2890	3174	3415	3815	4168	2414	
12		10	719	3309	3459	3609	3054	3257	3699	3903	4402	4695	2758	
		12	89	154	308	462	210	420	252	504	287	573	331	
		12	178	617	771	925	631	841	757	1009	860	1147	662	
		12	258	1079	1233	1387	1051	1261	1261	1514	1433	1720	954	
		12	357	1542	1595	1850	1471	1682	1766	2018	2007	2293	1325	
		12	446	2004	2153	2312	1992	2102	2270	2522	2580	2866	1656	
		12	535	2466	2621	2775	2312	2523	2775	3027	3153	3440	1987	
		12	624	2929	3083	3237	2733	2941	3279	3532	3726	4013	2319	
16		14	89	156	313	469	213	427	255	511	291	582	330	
		14	178	625	782	938	640	854	767	1022	873	1164	661	
		14	257	1094	1250	1407	1067	1280	1278	1533	1456	1747	991	
		14	356	1563	1719	1876	1494	1707	1789	2044	2038	2329	1322	
		14	445	1958	2115	2272	1872	2085	2340	2595	2850	3105	1887	
		14	535	2466	2621	2775	2312	2523	2775	3027	3153	3440	1987	
		14	624	2929	3083	3237	2733	2941	3279	3532	3726	4013	2319	
20		18	89	156	313	469	213	427	255	511	291	582	330	
		18	178	625	782	938	640	854	767	1022	873	1164	661	
		18	257	1094	1250	1407	1067	1280	1278	1533	1456	1747	991	
		18	356	1563	1719	1876	1494	1707	1789	2044	2038	2329	1322	
		18	445	1958	2115	2272	1872	2085	2340	2595	2850	3105	1887	
		18	535	2466	2621	2775	2312	2523	2775	3027	3153	3440	1987	
		18	624	2929	3083	3237	2733	2941	3279	3532	3726	4013	2319	
TOT.		22	89	156	313	469	213	427	255	511	291	582	330	
		22	178	625	782	938	640	854	767	1022	873	1164	661	
		22	257	1094	1250	1407	1067	1280	1278	1533	1456	1747	991	
		22	356	1563	1719	1876	1494	1707	1789	2044	2038	2329	1322	
		22	445	1958	2115	2272	1872	2085	2340	2595	2850	3105	1887	
		22	535	2466	2621	2775	2312	2523	2775	3027	3153	3440	1987	
		22	624	2929	3083	3237	2733	2941	3279	3532	3726	4013	2319	

Warrene Not more than 3 trees/plot

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VOLUME IN ROUGH CORDS PER ACRE. Multiply the sum of the last figures used in each block by 0.01 and then divide the total by the number of point samples tallied.

(Use reverse side for notes)

Note: Volume & tally survey are separate!

PLOT RADIUS LIMITS

The plot radius factor (PRF) for prism with basal area factor 10 is 2.75.
 For your own prism (other than BAF-10) calculate PRF and fill in blank column below. Use for trees of any size to determine if tree is in or out of plot. Select from table for desired DBH and sum up to get limit in feet. ~~omit~~ the decimal as needed.

DBH	Point Limits in Feet	
	BAF-10	BAF----
1	2.75	
2	5.50	
3	8.25	
4	11.00	
5	13.75	
6	16.50	
7	19.25	
8	22.00	
9	24.75	
10	27.50	

Example: For 12.8" DBH tree

DBH	Limit
10.0	27.5
2.0	5.5
.8	2.2
Total 12.8	35.2 FEET

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INTS LLIED	TREE TALLY AT POINT	D.B.H.	NO. OF 8' BOLTS PER TREE - Variable top to 4" d.i.b.								TALLY LEGEND			TOTAL CORDS/ACRE
			1	2	3	4	5	6	7	8	9	0	1	
1			87	143	285	428	204	408	240	479	X O X —			
			173	571	713	856	612	815	719	958				
2		6	260	999	1142	1284	1019	1223	1198	1437				
			347	1427	1570	1712	1427	1631	1677	1916				
3			433	1855	1998	2140	1835	2038	2156	2395				
			520	2283	2426	2568	2242	2446	2635	2874				
4			606	2711	2854	2996	2650	2854	3114	3353	5	6	7	
			89	143	287	430	195	390	249	499	304	608	332	
5			178	573	716	860	585	780	748	997	911	1215	665	
			267	1003	1146	1290	974	1169	1247	1496	1519	1823	997	
6		8	355	1433	1576	1720	1364	1559	1745	1995	2127	2430	1330	
			444	1863	2006	2150	1754	1949	2244	2493	2734	3038	1662	
7			533	2293	2436	2579	2144	2339	2743	2992	3342	3646	1995	
			622	2723	2866	3009	2534	2728	3241	3491	3949	4253	2327	
8			711	3153	3296	3439	2923	3118	3740	3989	4557	4861	2660	
			90	150	301	451	204	407	244	488	293	587	345	387
9			180	602	752	902	611	814	732	976	880	1174	690	774
			270	1053	1203	1354	1018	1221	1220	1464	1467	1761	1034	1161
10		10	359	1504	1654	1805	1425	1629	1707	1951	2054	2348	1379	1548
			449	1955	2105	2256	1832	2036	2195	2439	2641	2934	1724	1935
11			539	2406	2557	2707	2239	2443	2683	2927	3228	3521	2069	2322
			629	2857	3008	3158	2646	2850	3171	3415	3815	4108	2414	2709
12			719	3309	3459	3609	3054	3257	3659	3903	4402	4695	2758	3096
			89	154	308	462	210	420	252	504	287	573	331	382
13			178	617	771	925	631	841	757	1009	860	1147	662	764
			268	1079	1233	1387	1051	1261	1261	1514	1433	1720	994	1147
14		12	357	1542	1696	1850	1471	1682	1766	2018	2007	2293	1325	1529
			446	2004	2158	2312	1892	2102	2270	2522	2580	2866	1656	1911
15			535	2466	2621	2775	2312	2523	2775	3027	3153	3440	1987	2293
			624	2929	3083	3237	2733	2943	3279	3532	3726	4013	2319	2675
16			89	156	313	469	213	427	256	511	291	582	330	374
		14	178	625	782	938	640	854	767	1022	873	1164	661	749
17			267	1094	1250	1407	1067	1280	1278	1533	1456	1747	991	1123
			356	1563	1719	1876	1494	1707	1789	2044	2038	2329	1322	1498
18			87	158	315	473	215	430	263	526	301	602	336	380
		16	175	631	789	946	645	860	789	1053	903	1204	672	760
19			262	1104	1262	1420	1076	1291	1316	1579	1505	1806	1008	1140
		18	88	160	319	479	216	432	266	532	313	626	340	368
20			175	638	798	958	649	865	798	1064	939	1252	680	736
		20	89	162	324	486	220	441	271	542	312	624	349	372
			178	648	810	972	661	881	812	1083	936	1248	698	744
TOT.		22	91	167	334	500	227	455	277	553	318	637	352	379
			182	667	834	1001	682	910	830	1107	955	1273	704	758

VOLUME IN ROUGH CORDS PER ACRE Multiply the sum of the last figures used in each block by 0.01 and then divide the total by the number of point samples tallied.